# WHFS WFO Site-Specific Forecast Model:

**General Overview and Background Information:**

The WHFS Site-Specific Hydrologic Forecast Model is currently under development by OHD (Office of Hydrologic Development) and the MBRFC (Missouri Basin RFC). This document is designed to give quick step by step instructions in the use of WHFS WFO Site-Specific.

The design criteria of WFO Site-Specific is as follows:

* Simple to learn and efficient to use.
* Low maintenance.
* Produces a complete forecast hydrograph.
* Reasonably accurate results.
* Compares favorably with existing models.
* Capable of handling complex rainfall events.
* Utilizes information already available in the WHFS.
* Requires no new products from the RFC's.
* Modular - allowing future enhancements.
* An integral part of WHFS.
* Deliverable with AWIPs Build 5.1.2.

The current functionality of WFO Site-Specific is as follows:

* Operates at 1- hour time steps.
* Ingests user-selected 1 - hour MAP time series.
* Accesses unitgraph, rating curve, and FS from the DB to compute 1 - hour TRO.
* Using the issued 1 - hour FFH values and the TRO, computes a soil moisture mixture index (SMI) using the MKC-API approach.
* Applies accumulated 1 - hour MAPs to the computed SMI to derive accumulated runoff throughout the event.
* Determines the incremental 1 - hour runoff time series.
* Applies the runoff time series to the unitgraph for the basin to produce a discharge hydrograph.
* Utilizes the rating curve to create a forecast stage hydrograph.

The functionality of WFO Site-Specific was tested. This included:

* Comparison of rainfall/runoff curves generated by site-specific model with those generated by OFS.
* Site-Specific crests near FS for precipitation equal to 1, 3, and 6 - hour FFH values.
* Site-Specific versus HW table crests for 3 - hour events of various magnitudes.
* Case studies.

**Steps to Run WHFS WFO Site-Specific:**

Important: To get a station to come up in the Site-Specific application it must have the following:

* A rating curve defined - see Rating Curve... under RiverGage in HydroBase.
* A unit hydrograph defined - see Unit Hydrograph... under RiverGage in HydroBase.
* A flood stage defined - see RiverGage... under RiverGage in HydroBase.

To do anything (Site-Specific wise) with the station you will need to have some FFH values in the database for the past 5 days. These are stored in the ContingencyValue table.

The steps to run WHFS WFO Site-Specific with the expected result:

**1)** Select Site Specific Headwater Model from the LiveData cascading menu in HydroView.

Result: The Site-Specific main window comes up for the first (alphabetically) valid Site-Specific station.

**2)** Select a station from the Current Station ID option menu (see Figure 1).

Result: The Name, River, Flood Stage, Flood Flow, UHG Peak Flow and Threshold Runoff fields will be updated. The Start Time and End Time will be updated if a FFH value exists for this station within the past five days. If not, an error dialog will be displayed. The Starting Stage Value option menu will be updated if a FFH value exists and there is observed stage for that station.

**3)** Select an initial FFH from the Start Time option menu (see Figure 1).

Result: The Start Time and FFH selected will be used for the initial precipitation and forecast stage calculations. The End Time will be set to 12 hours beyond the Start Time. The Starting Stage Value option menu will also be updated if there is observed stage for that station.

**4)** Select a radar from the radar ID option menu (see Figure 1).

Result: The radar selected will be the one used for the initial precipitation calculations.

**5)** Press the Get Initial Precip pushbutton (see Figure 1).

Result: MAP and Forecast Stage Window comes up.

**6)** Press the Edit MAPs pushbutton on the MAP and Forecast Stage Window (see Figure 2).

Result: The MAP tabular editor window comes up.

**7)** Edit a MAP value and press the Apply pushbutton on the MAP tabular editor window (see Figure 2).

Result: The MAP bar graph is updated on the MAP and Forecast Stage Window. The hydrologic model is run and the Forecast Stage x-y graph is updated.

**8)** Press the Close pushbutton on the MAP tabular editor window (see Figure 2).

Result: The MAP tabular editor window is closed and any edits made to the MAP values since the last Apply are NOT saved.

**9** If you want to run the model for additional scenarios, minimize or close the forecast stage window. Then press the Add'l Analysis Window pushbutton on the Site Specific Main Window (see Figure 1). Result: An additional MAP and Forecast Stage Window comes up. Repeat steps 6, 7, and 8. (If you don't want to evaluate additional scenarios, skip to step 10).

**10)** If you want to edit the forecasted stage values, press the Edit Stage pushbutton on the MAP and Forecast Stage Window. Result: The forecast stage tabular editor window comes up. (If you are satisfied with the forecasted stages and you don't want to edit the stage values, skip to step 13).

**11)** Edit a stage value and press the Apply pushbutton to the forecast stage tabular editor window (see Figure 3).

Result: The Forecast Stage x-y graph is updated.

**12)** Press the Close pushbutton on the forecast stage tabular editor window (see Figure 3).

Result: The forecast stage tabular editor window is closed and any edits made to the stage values since the last Apply are NOT saved.

**13)** Press the Save to Database pushbutton on the MAP and Forecast Stage Window (see Figure 4).

Result: Saves all of the forecast stage values to the IHFS database.

**14)** Select a SHEF Type Source FF from the Type Source option menu (see Figure 4).

Result: The Type Source FF will be the one used when the forecast stage values are saved to the IHFS database.

**15)** Use the displayed SHEF Qualifier Z from the SHEF Qualifier option menu (see Figure 4).

Result: The SHEF Qualifier Z will be the one used when the forecast stage values are saved to the IHFS database.

**16)** Edit the Prod ID text box if you wish to use a Prod ID different from the one displayed (see Figure 4).

Result: The product ID entered in the text box will be the one used when the forecast stage values are saved to the IHFS database.

Other Features

**17)** Press the Show Flood Stage toggle button on the MAP and Forecast Stage Window (see Figure 4) to toggle on and off the displaying of the Flood Stage line on the Forecast Stage x-y graph.

**18)** Press the Show Observed data toggle button on the MAP and Forecast Stage Window (see Figure 4) to toggle on and off the displaying of observed data (if available) on the Forecast Stage x-y graph.

**19)** Press the About pushbutton on the MAP and Forecast Stage Window (see Figure 4)to display the version number and date information.

**20)** Press the Close pushbutton on the MAP and Forecast Stage Window (see Figure 4).

Result: The MAP and Forecast Stage Window is closed.

This concludes the instructions.

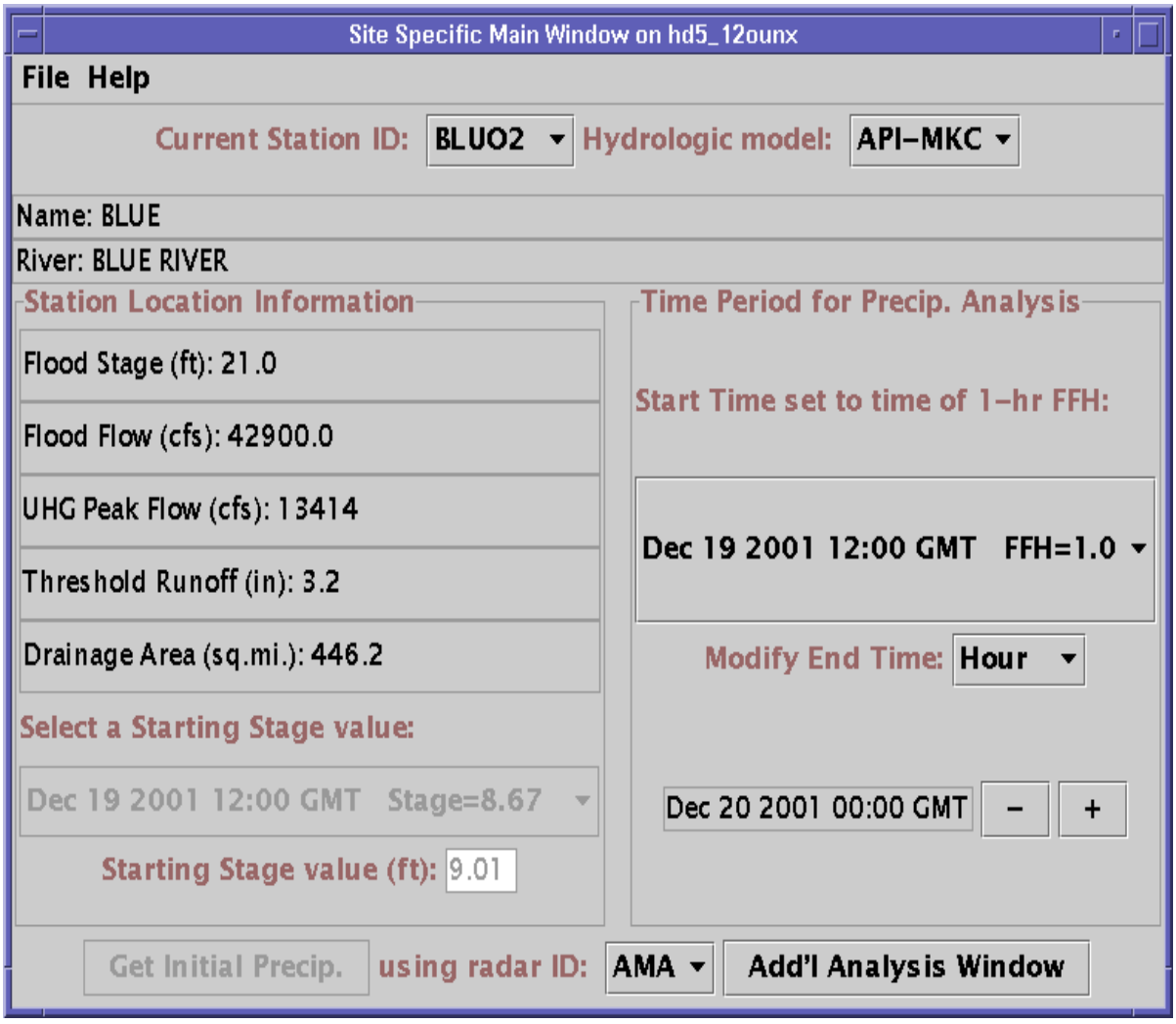


**Figure 1: Site Specific Main Window.**

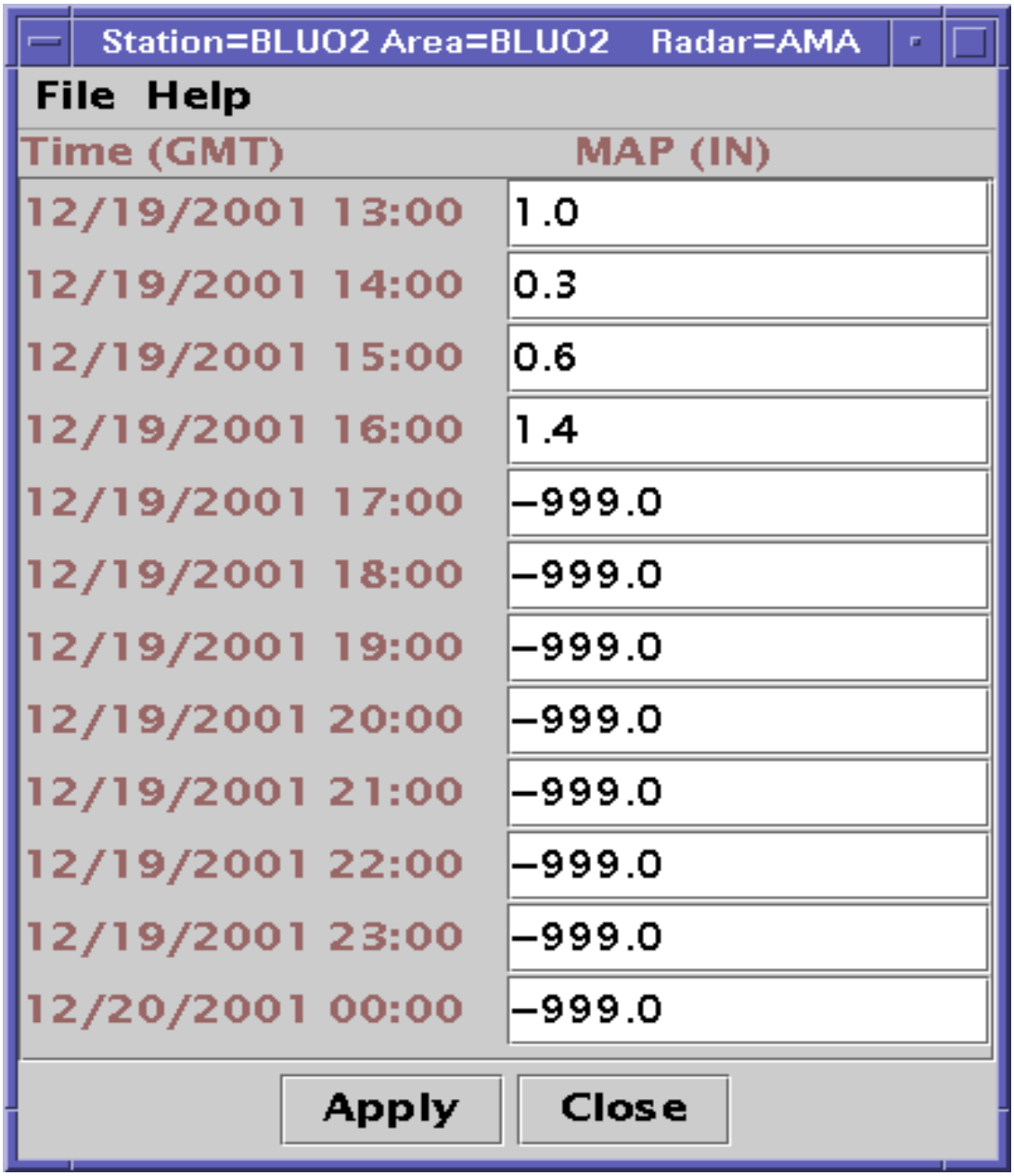


**Figure 2: MAP Tabular Editor Window.**

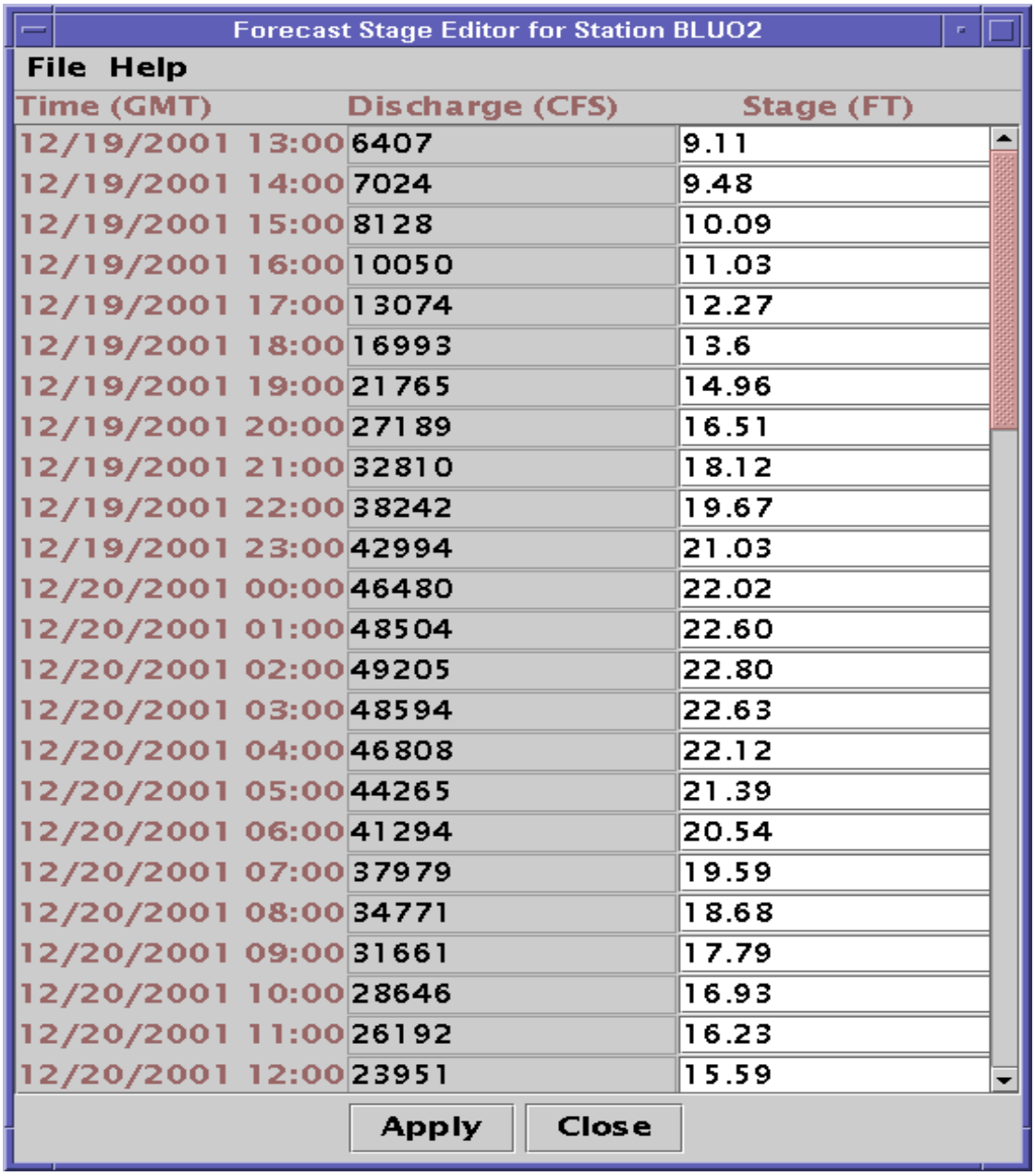


**Figure 3: Forecast Stage Editor Window.**

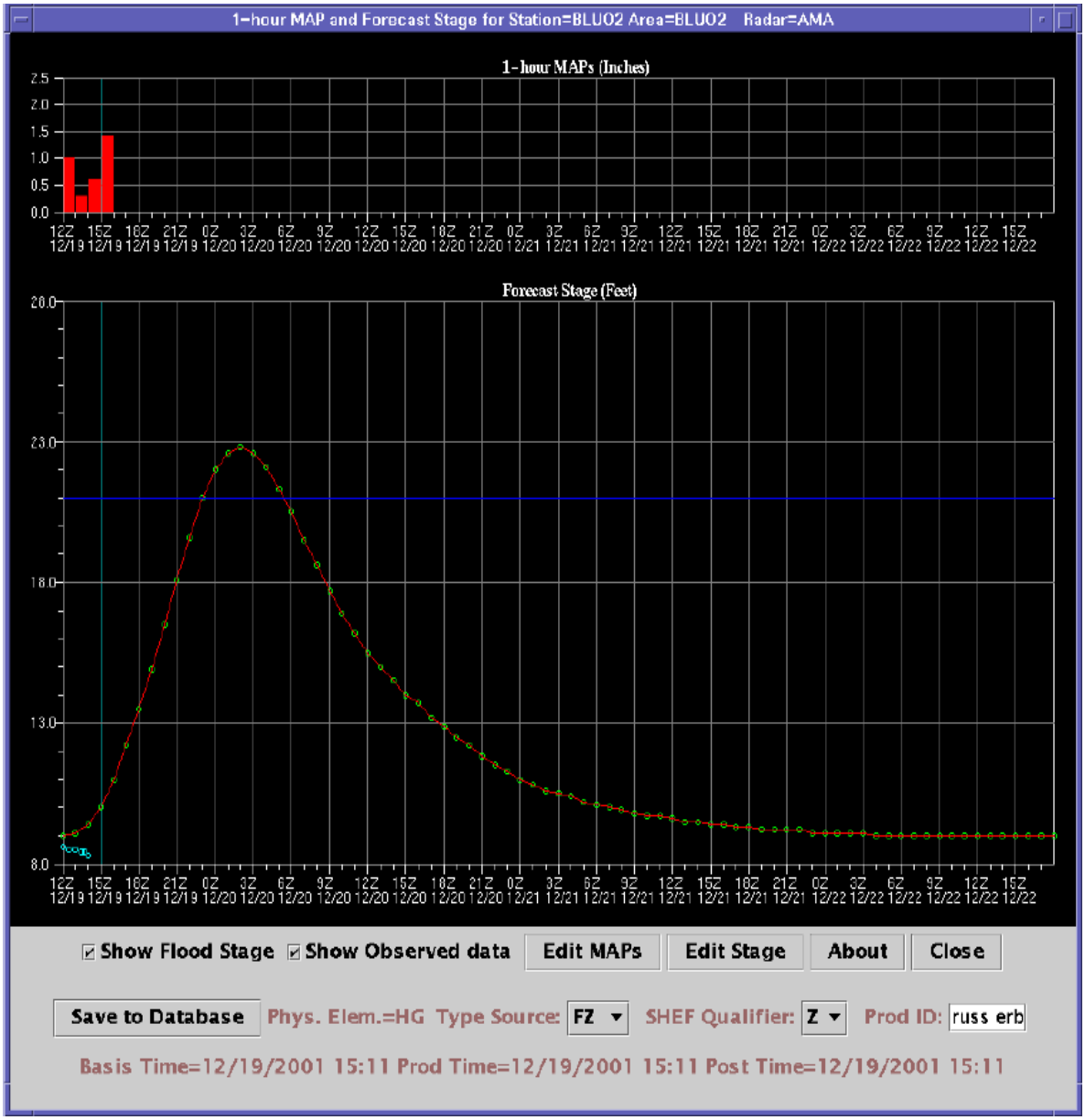


**Figure 4: Hydrograph Editor Window.**

**Conclusions:**

* For crest forecasts, at least, the test results seem to be within reasonable limits.
* Crests produced by the site-specific model compare to HW Tables and OFS within half a foot on average.
* Likewise, for rainfall equaling 1, 3, and 6 - hour FFH values, the produced crests are within half a foot of FS on average.
* The rainfall-runoff curves produced by the site-specific model appear to be slightly "drier" than those produced by OFS (SAC-SMA), however the difference is only significant for extremely dry conditions and low threshold runoff values.
* For the twelve models studied, the Site-Specific model performed well, as long as accurate estimates of hourly precipitation were available, and the issued FFH values accurately represented soil moisture conditions. For 10 of 12 events this seemed to be the case.
* To this point, testing has been for average to above average moisture conditions. Further testing is necessary for relatively dry soil conditions.

**Future Testing/Improvements:**

* Testing in other areas - RFCs/WFOs.
* Trying Site-Specific computations to gridded rather than FFH values.
* Improved handling of multi-zone basins.
* Handling snow modeling in the SSM.
* Making proper baseflow adjustments.
* Enhanced rainfall/runoff modeling.
* Distributed modeling approach.